

EMC TEST REPORT


According to

IEC 60945:2002


Test Report No. : BWS-06-EC-0156
Equipment : Search And Rescue Transponder(SART)
Model No : SAR-9
Applicant : SAMYUNG ENC CO., LTD.
1123-17, Dongsam-Dong, Youngdo-Gu, Busan 606-083, Korea
Manufacturer : SAMYUNG ENC CO., LTD.
1123-17, Dongsam-Dong, Youngdo-Gu, Busan 606-083, Korea
Date of Incoming : November 22, 2006
Date of Issuing : December 05, 2006

This report applies only to the product named in the title of this report manufactured at the location indicated. Test results apply only to the particular equipment and functionality described in this test report.

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1. General Description of EUT

1.1 Applicant

Company Name	: SAMYUNG ENC CO., LTD.
Address	: 1123-17, Dongsam-Dong, Youngdo-Gu, Busan 606-083, Korea
Contact Person	: Ku, Jung-Won/ Manager
Phone/Fax	: Tel No. : 82-51-601-6681 Fax No. : 82-51-601-6680
E-Mail	: Numb999@hotmail.com

1.2 Manufacturer

Company Name	: SAMYUNG ENC CO., LTD.
Address	: 1123-17, Dongsam-Dong, Youngdo-Gu, Busan 606-083, Korea

1.3 Basic Description of EUT

Trade Name	: -
Product Name	: Search And Rescue Transponder(SART)
Model Name	: SAR-9
Serial Number	: Prototype
Input Rating	: Battery

1.4 Technical Description of EUT

1. Frequency range : 9.2 to 9.5 GHz

2. Antenna

Polarization : Horizontal

Vertical beam width : $\pm 12.5^\circ$

Azimuthally beam width : Omni directional to $\pm 2\text{dB}$

3. Transmitter

Radiated Power : $> 400 \text{ mW}$ (+26dBm)

Form of sweep : Saw tooth (12 sweeps)

Pulse emission : $< 100 \mu\text{s}$

Forward sweep time : $7.5 \mu\text{s} \pm 1 \mu\text{s}$

Return sweep time : $0.4 \mu\text{s} \pm 0.1 \mu\text{s}$

Recovery time : $< 10 \mu\text{s}$

Response delay : $< 0.5 \mu\text{s}$

4. Receiver

Effective sensitivity : better than -50dBm

5. Battery

Duration of operation : 96 hours in standby condition followed by a minimum 8 hours of transmission

While being continuously interrogated by an X-band radar with a pulse repetition frequency of 1 kHz

Battery life : 5 years

6. Temperature range

Operating temperature : -20°C to $+55^\circ\text{C}$

Storage temperature : -30°C to $+65^\circ\text{C}$

2. General Information of Test

2.1 Test Facility

This test was carried out by BWS TECH Inc.

Test Site Location : 611-1, Maesan-ri, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, Korea
 TEL : 82-31-333-5997
 FAX : 82-31-333-0017

2.2 Standard for Methods of Measurement

Applied Standard	Test Method	Description	Test Result
IEC 60945:2002	CISPR 16-1:1999	Disturbance Radiation emission Test	NA (Refer to Note)
		Mains Terminal Disturbance Voltage	Met / Pass
	IEC 61000-4-2:1995	Electrostatic discharge Immunity	Met Criterion A / Pass
	IEC 61000-4-3:1995	Radiated RF E-Field Immunity	Met Criterion A / Pass
	IEC 61000-4-4:1995	Burst immunity	NA (Refer to Note)
	IEC 61000-4-5:1995	Surge immunity	NA (Refer to Note)
	IEC 61000-4-6:1996	Conducted RF Immunity	NA (Refer to Note)
	IEC 61000-4-11:1994	Voltage dips and interruptions Immunity	NA (Refer to Note)

NOTE : It needs not test requirement because the EUT power supplies from battery.

2.3 Description of EUT modification

The device tested is not modified anything, mechanical or circuits to improve EMI status during a test. No EMI suppression device(s) was added and/or modified during testing.

2.4 Variations covered by this report

Model Differences : N/A

2.5 Test Conditions

EUT Operating Mode

EUT was tested according to the following operation modes provided by the specifications given by the manufacturer, and reported the worst emissions.

Operation Modes
- ON mode operation

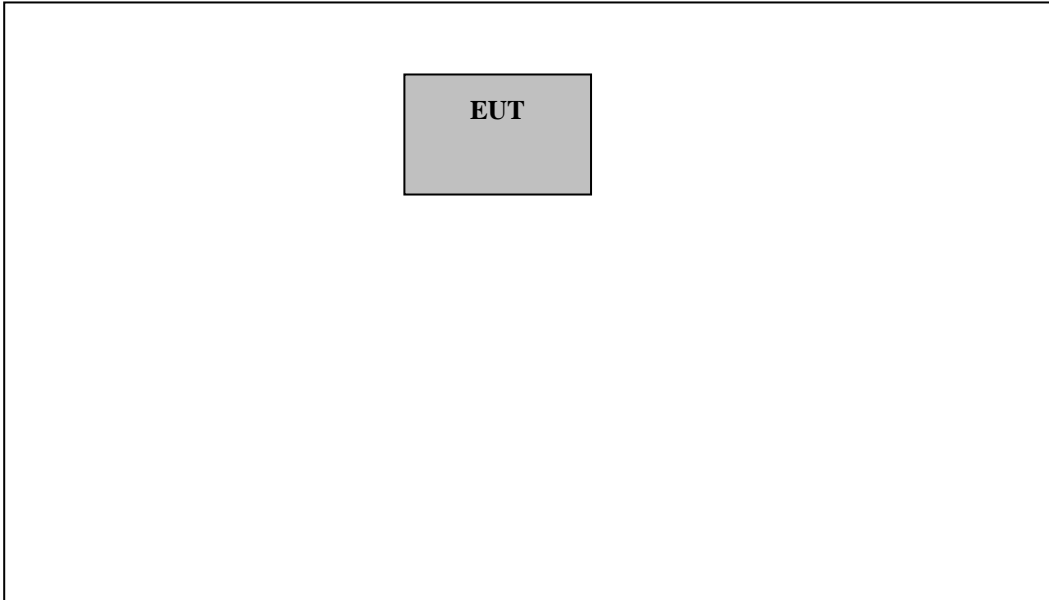
PASS/FAIL Criteria for Immunity Test

Criteria	During Test	After Test
A	Operate as intended No loss of function No degradation of performance No unintentionally transmit or change its actual operating state and stored data.	- . Operate as intended - . No loss of function - . No degradation of performance - . No loss of stored data or user programmable functions
B	May show loss of function May show degradation of performance	- . Function shall be self recoverable - . Shall operate as intended after recovery - . No degradation of performance - . No loss of functions - . No loss of stored data or user programmable functions
C	May be loss of function(one or more)	- . Function shall be restored by the operator control - . Shall operates intended after recovery

Table 1. Performance Criteria

Test System layout on EUT and peripherals (EMI & EMS)

—— Interface cable ——— Power cable



2.6 Description of Test System(EMI and EMS)

Type of Peripheral Equipment Used:

Description	Model Name	Serial No.	Manufacturer
EUT	SAR-9	N/A	SAMYUNG ENC CO., LTD.

Type of Cables Used:

Device from	Device to	Type of port	Length (m)	Type of shield

3.1 Power Line Conducted Emission Tests

The mains terminal of the EUT was measured in a shield room. The EUT was connected to an artificial mains network (AMN) placed on the floor and placed on non-metallic table 0.8 m above the metallic, grounded floor. The AMN was 0.8 m from the EUT and at least 0.8 m from other units and other metal planes. The measurements were performed with a quasi-peak detector and an average detector.

3.1.1 Test Condition

Frequency Range of Test : 10 kHz to 30 MHz
 Test Standard : IEC 60945:2002
 Test Method : CISPR 16-1:1999
 Test Date : December 2, 2006
 Temperature/Humidity : 26 °C/ 42 %

3.1.2 Test Standard.

Frequency Range (MHz)	Limit (dBuV)	
	Quasi-Peak	Average-Peak
0.01 ~ 0.15	96 - 50	-
0.15 ~ 0.35	60 - 50	-
0.35 ~ 30	50	-

3.1.3 Test Equipment List

Equipment Type	Model	Manufacture	Serial No	Cal Due Date	Use
Signal Analyzer	PMM9000	PMM	3100570602	09. 22. 2007	<input checked="" type="checkbox"/>
LISN Multiline	L1-115	Com-Power	241018	11. 13. 2007	<input checked="" type="checkbox"/>
Conducted Cable	CC-10	N/A	BWS-02	N/A	<input checked="" type="checkbox"/>

3.1.4 Test Result of Power Line Conducted Emission.

EUT : SAR-9
Used to Battery

Power Line Conducted Emission Test Results : **Not tested.**

Test data sheets follow.

Freq [MHz]	Correction		Phase [H/N]	Quasi-Peak Mode				Average Mode			
	AMN	C.L		Limit	Reading	Emission Level	Margin	Limit	Reading	Emission Level	Margin
				[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]

Notes :

- Margin = Limit - Emission Level
- All modes of operation were investigated and the worst-case emissions are reported. See the plots in next pages.
- Measurement uncertainty estimated at ± 3.45 dB.
The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k=2$.



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3.2 Radiated Emission Tests

The frequency range investigated was 0.15 MHz to 2000 MHz.

All data results were a quasi-peak unless stated otherwise; a Biconical & Log-periodic antenna were tuned to the frequency during preliminary radiated measurements. The EUT, support equipment and interconnected cables were re-configured to produce the Maximum emission for the frequency and were placed on top of a 0.8 m a high non-metallic 1 × 1.5 m table. The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each a EME emission. The turntable containing the system was rotated and the antenna height was varied 1 to 4 m and stopped at the azimuth and the height producing the maximum emission. And this device (EUT) was tested in 3 orthogonal planes. The antenna measured both horizontal and vertical polarization.

3.2.1 Test Condition

Frequency Range of Test	: 0.15 MHz to 2000 MHz
Test Standard	: IEC 60945:2002
Test Method	: CISPR 16-1:1999
Test Date	: December 2, 2006
Temperature/Humidity	: 2 °C/ 36 %

3.2.2 Test Standard

Frequency Range (MHz)	Limit (dBuV/m)	
	Quasi-Peak	Peak
0.15 ~ 0.30	80 - 52	N/A
0.30 ~ 30	52 - 34	N/A
30 ~ 2000	54	N/A
0.156 ~ 0.165	24	30

3.2.3 Test Equipment List

Equipment Type	Model	Manufacture	Serial No	Cal Due Date	Use
Bilog Antenna	VULB 9160	SCHWARZBECK	9160-3122	12. 16. 2006	<input checked="" type="checkbox"/>
Antenna Mast	JAC-3	DAIL EMC	N/A	N/A	<input checked="" type="checkbox"/>
Antenna Turntable Controller	JAC-2	JAEMC	N/A	N/A	<input checked="" type="checkbox"/>
EMI Receiver	ESVN 30	ROHDE & SCHWARZ	832854/010	06. 22. 2007	<input checked="" type="checkbox"/>
Open Site Cable	OSC-30	N/A	BWS-01	N/A	<input checked="" type="checkbox"/>
Loop Antenna	HFH2-Z2	ROHDE & SCHWARZ	881056/6	08. 19. 2007	<input checked="" type="checkbox"/>
Horn Antenna	BBHA -120D	SCHWARZBECK	BBHA9120D 234	02. 07. 2007	<input checked="" type="checkbox"/>

3.2.4 Test Result of Radiated Emission

EUT : **SAR-9**
Test distance : **3 m, 10 m**

Radiated Emission Test Results : **PASS**

Test data sheets follow.

Frequency [MHz]	Reading [dB μ V]	Polarization [*H/**V]	Ant.Factor [dB]	Cable Loss [dB]	Limit [dB μ V/m]	Emission Level [dB μ V/m]	Margin [dB]
0.178	50.92	V	-	-	76.20	56.02	20.18
0.198	36.56	V	-	-	76.10	53.98	22.12

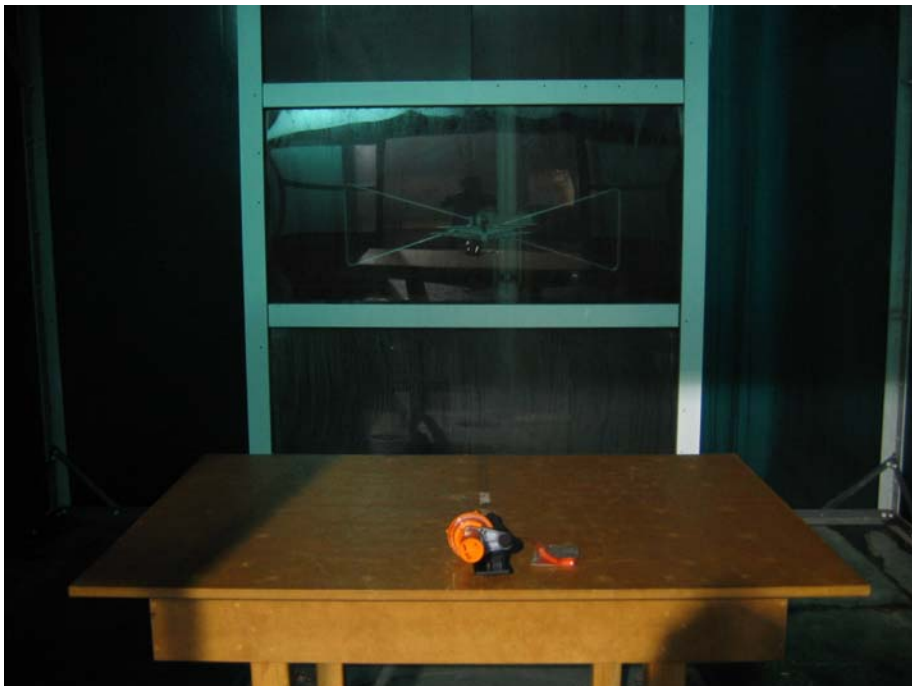
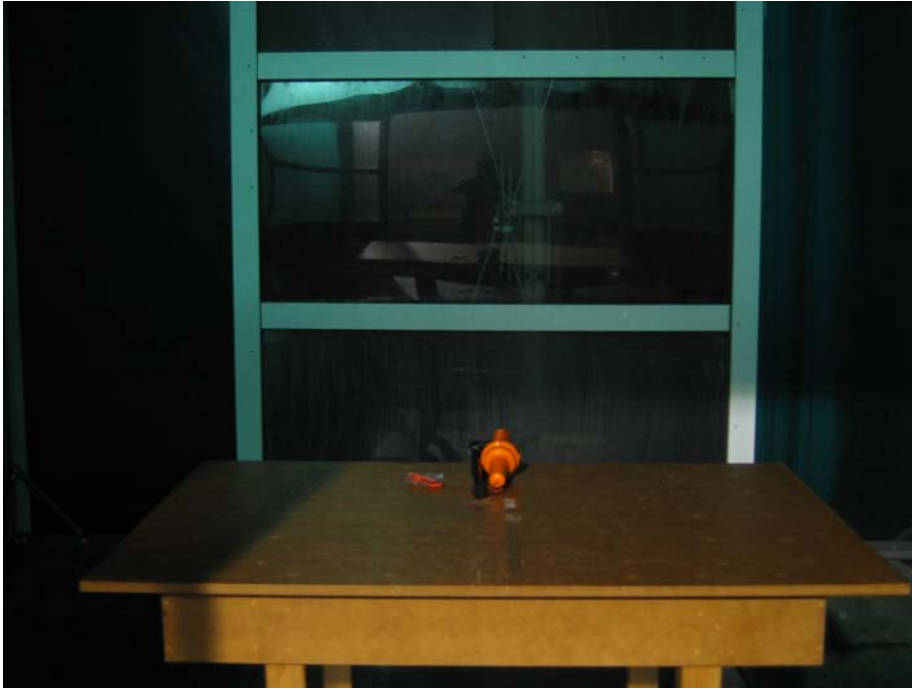
Notes

- * H : Horizontal polarization , ** V : Vertical polarization
- Emission Level = Reading + Antenna factor + Cable loss
- Margin value = Limit - Emission Level
- All other emissions not reported were more than 25dB below the permitted limit.
- Measurement uncertainty estimated at ± 4.12 dB.
The measurement uncertainty is given with a confidence of 95 % with the coverage factor, k=2.



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3.2.5 Photographs of Radiated Emission Test Configuration



3.3 Electrostatic Discharge Immunity Test

In order to minimize the impact of environmental parameters on test results, the tests shall be carried out in climatic and electromagnetic reference conditions as specified in IEC 61000-4-2:1995.

The test programs and software shall be chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.

The testing shall be performed by direct and indirect application of discharges to the EUT according to a test plan.

3.3.1 Test Condition

EUT : SAR-9
 Test Standard : IEC 60945:2002
 Test Method : IEC 61000-4-2:1995
 Test Date : December 2, 2006
 Performance criterion : B
 Temperature/Humidity/Pressure : 27 °C/ 42 %/ 101.6 kPa

3.3.2 Test Equipment List

Equipment Type	Model	Manufacture	Serial No	Cal Due Date	Use
ESD Simulator	MZ-15	KeyTek	9109321	12. 14. 2006	<input checked="" type="checkbox"/>
EN OMNI-TIP	TPC-2	KeyTek	9109338	12. 14. 2006	<input checked="" type="checkbox"/>

3.3.3 Test Result of Electrostatic Discharge Immunity Test

Electrostatic Discharge Immunity Test : PASS

The equipment meets the requirements.

Test data sheet follows.

Test Point	Discharge Type CD=Contact AD=Air	Test Voltage(kV)	Tested No	Observation	Result (performance criteria)
VCP	CD	±2,4,6 kV	Each 10 times	Normal	PASS (A)
HCP	CD	±2,4,6 kV	Each 10 times	Normal	PASS (A)
F & R Case	AD	±2,4,8 kV	Each 10 times	Normal	PASS (A)
L & R Case	AD	±2,4,8 kV	Each 10 times	Normal	PASS (A)
Front Ring	CD	±2,4,6 kV	Each 10 times	Normal	PASS (A)



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Remarks

The primary functions as described below were fully functional during and after test.

1. Normal operation mode

3.3.4 Photographs of Electrostatic Discharge Immunity Test Configuration



[Test Point] AD → CD →

Front



[Test Point] AD → CD →

Rear



3.4 Radiated, radio-frequency, electromagnetic field immunity test

Tests were conducted in accordance with IEC 61000-4-3:1995 over the frequency range of 80 MHz to 2000 MHz. The transmitting antenna was located 3 meters from the EUT at a height of 1 meter above the floor. Front, sides and back of the EUT were exposed to a uniform field of 10 V/m using both horizontal and vertical antenna polarizations.

3.4.1 Test Condition

EUT : SAR-9
 Test Standard : IEC 60945:2002
 Test Method : IEC 61000-4-3:1995
 Test Date : December 2, 2006
 Test field strength (V/m) : 3 V/m
 Performance criterion : A
 Temperature/Humidity/Pressure : 26 °C/ 43%/ 101.6 kPa

3.4.2 Test Equipment List

Equipment Type	Model	Manufacture	Serial No	Cal Due Date	Use
Signal Generator	2031	MARCONI	119691/083	08.21. 2007	<input checked="" type="checkbox"/>
Power Meter	NRVS	ROHDE & SCHWARZ	DE24961	12. 12. 2006	<input checked="" type="checkbox"/>
Bilog Antenna	VULB 9161	SCHWARZ BECK	9161-4068	11. 23. 2007	<input checked="" type="checkbox"/>
Directional Coupler	778D	H.P	17577	10. 11. 2007	<input checked="" type="checkbox"/>
Power Sensor	NRV-Z31	ROHDE & SCHWARZ	DE24961	12. 12. 2006	<input checked="" type="checkbox"/>
RF Power Amplifier	5127R	ORHIR RF	1008	03. 17. 2007	<input checked="" type="checkbox"/>
Horn Antenna	BBHA -120D	SCHWARZBECK	BBHA9120D 234	02. 07. 2007	<input checked="" type="checkbox"/>
RF Power Amplifier	5143R	ORHIR RF	1005	01. 03. 2007	<input checked="" type="checkbox"/>

3.4.3 Test Result of Radiated, radio-frequency, electromagnetic field immunity test

Electromagnetic field immunity test : PASS

The equipment meets the requirements.

Test data sheet follows.

Frequency Range (MHz)	Position (Angle)	Antenna Polarity	Field Strength (V/m)	Modulation	Result (performance criteria)
80-2000	Front	Vertical	10	80 % AM(1 kHz)	PASS(A)
80-2000	Rear	Vertical	10	80 % AM(1 kHz)	PASS(A)
80-2000	Right	Vertical	10	80 % AM(1 kHz)	PASS(A)
80-2000	Left	Vertical	10	80 % AM(1 kHz)	PASS(A)
80-2000	Front	Horizontal	10	80 % AM(1 kHz)	PASS(A)
80-2000	Rear	Horizontal	10	80 % AM(1 kHz)	PASS(A)
80-2000	Right	Horizontal	10	80 % AM(1 kHz)	PASS(A)
80-2000	Left	Horizontal	10	80 % AM(1 kHz)	PASS(A)

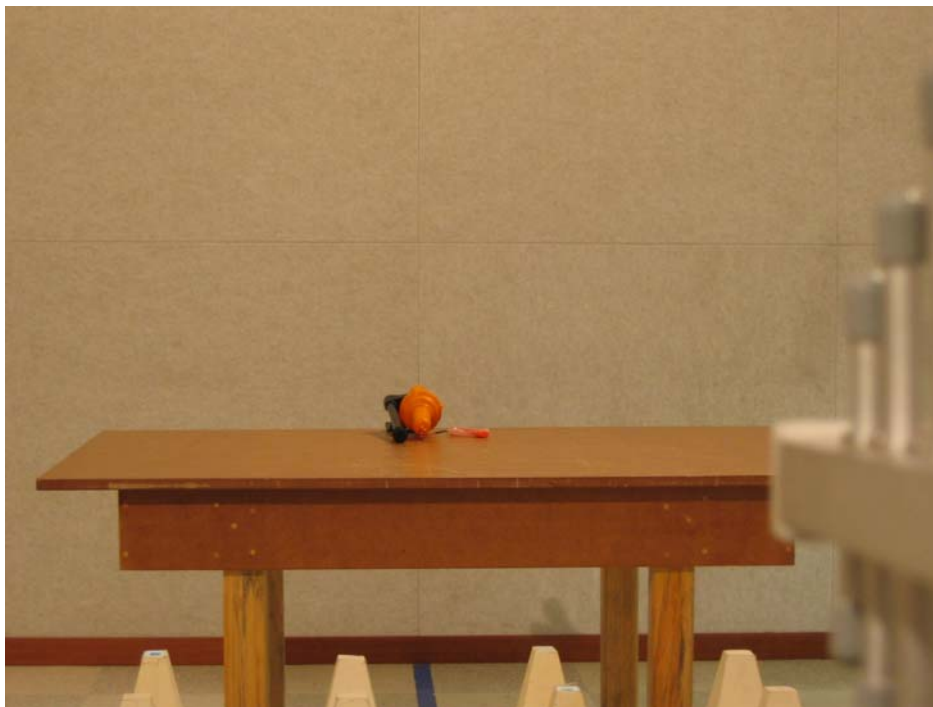

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Remarks

The primary functions as described below were fully functional during and after test.

1. Normal operation mode

3.4.4 Photographs of Radiated, radio-frequency, electromagnetic field immunity test Configuration



4. EUT PHOTOGRAPHS

[Front of EUT]



[Back of EUT]



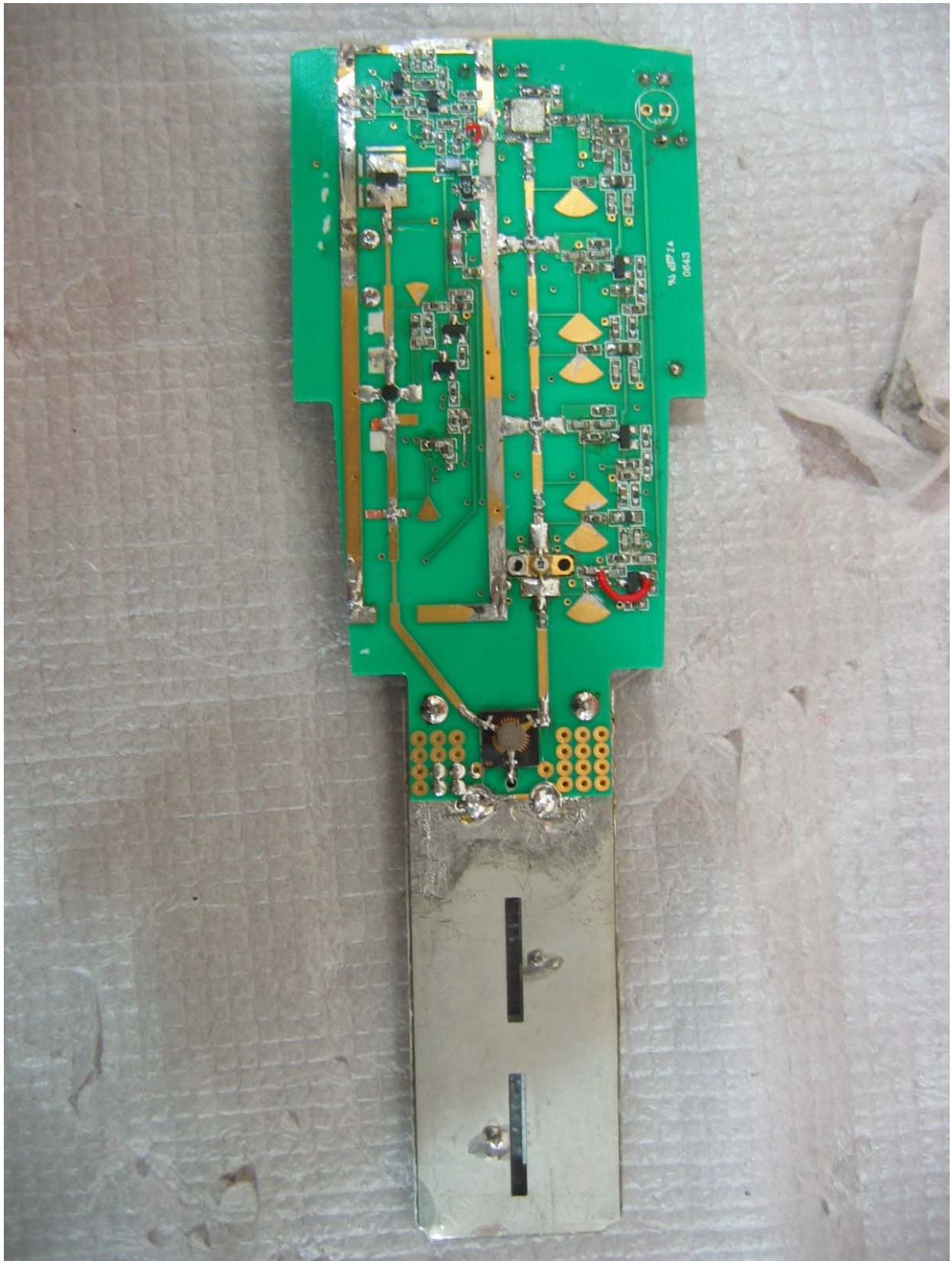
[Internal of EUT]



Top of control board side



Bottom of control board side



Battery

